SMS Rule Revisions Discussion

Jan 7, 2010
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Outline

- Areas of adjustments
- Narrowing down options
- Setting sediment cleanup standards
- Regional background example
- Lower Duwamish example
- Discussion

Areas of adjustment

Set Cleanup Standard

- Consideration of background
- Exposure assumptions
- Acceptable risk range or range of effects.

Remedy Selection and Implementation

- Engineered controls
- Institutional controls
- Remediation Levels
- Recovery Time Frame

Resolution

- Compliance
  - Location
  - Concentration (Statistical comparison)
  - Time
- Interim actions
- Sediment Recovery Zones
- Partial Settlements?
- Mitigation?

Internal Process & Participants

- Ecology workgroup (6-8 people)
- Clean Team (All Ecology technical staff for sediments)
- MTCA Site Manager Meetings
- Toxics Cleanup Program Managers

- Define issue
- Workgroup considered many options – brought 5 options forward for further discussion.
- Narrowed down to two options in order to focus the discussion.

Risk Levels

MTCA : 1×10^{-6} for single chemical/pathway and

1×10^{-5} for multiple chemicals/pathways

1×10^{-5} for industrial settings, some other conditions

WA Water Quality Standards – 1×10^{-6} (6.5 gr/day IR)

WA Dept of Health fish advisories – 10^{-4}

USEPA CERCLA – 10^{-4} to 10^{-6}

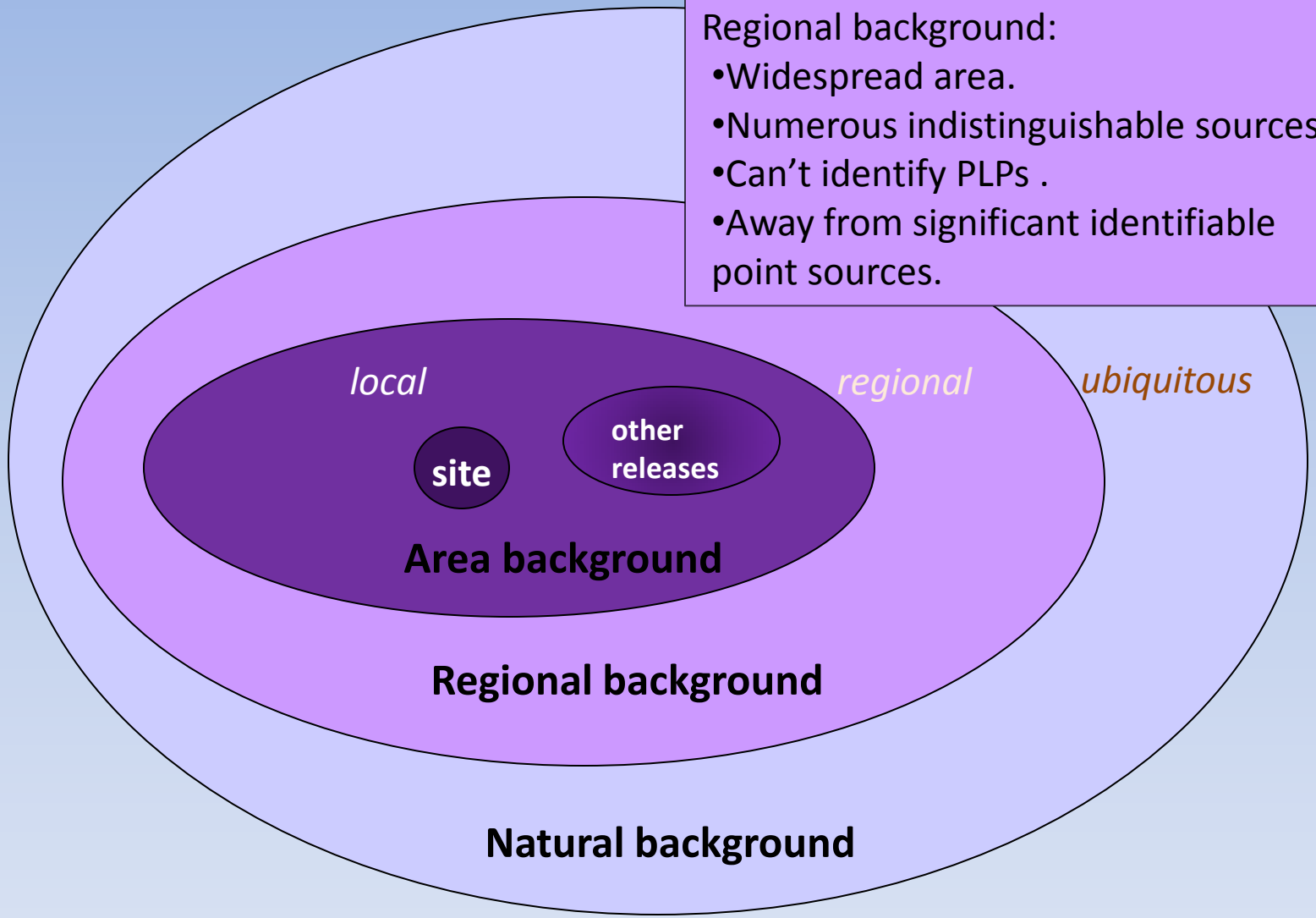
Other states – 1×10^{-5} to 1×10^{-6}

Background

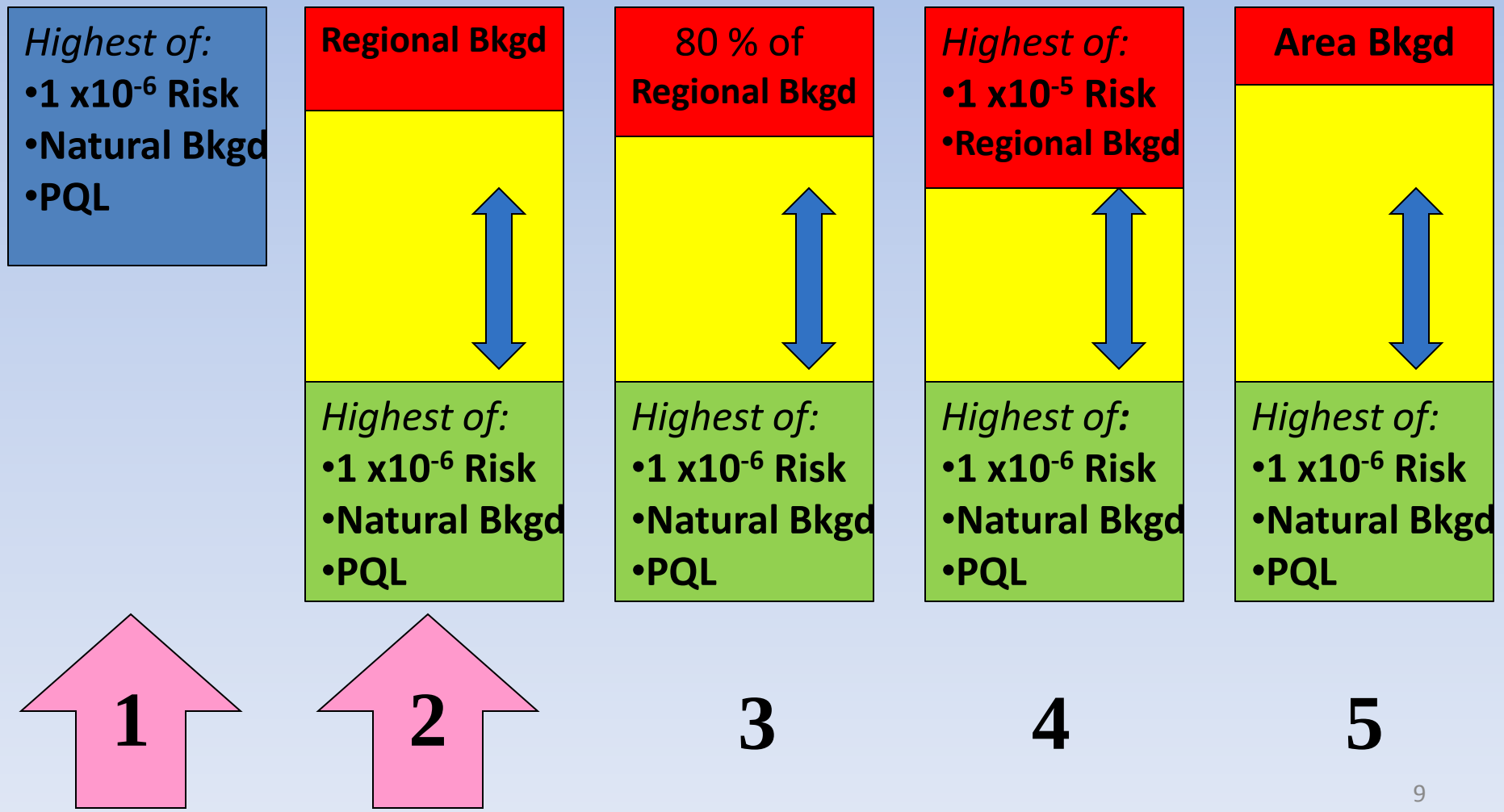
- MTCA definitions
  - “Natural Background”
  - “Area Background”
- Sediment Management Standards
  - “Non-anthropogenic Background”
- USEPA CERCLA
  - “Natural Background”
  - “Anthropogenic Background”
- Other ideas
  - Regional Background
  - Habitat stratified background
  - AKART background

Background Conceptual Site Model

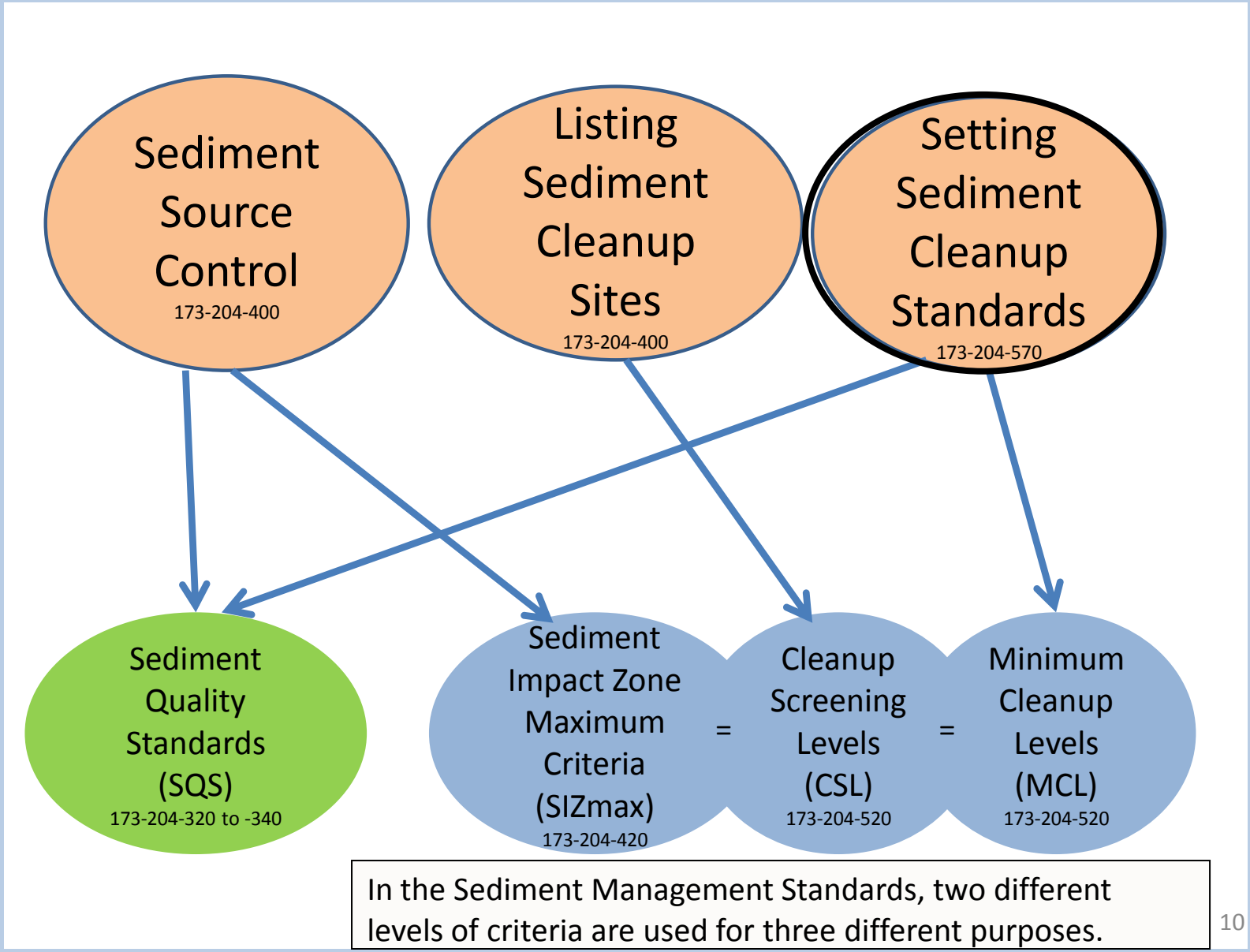
Regional background:
- Widespread area.
- Numerous indistinguishable sources.
- Can't identify PLPs .
- Away from significant identifiable point sources.



5 Options

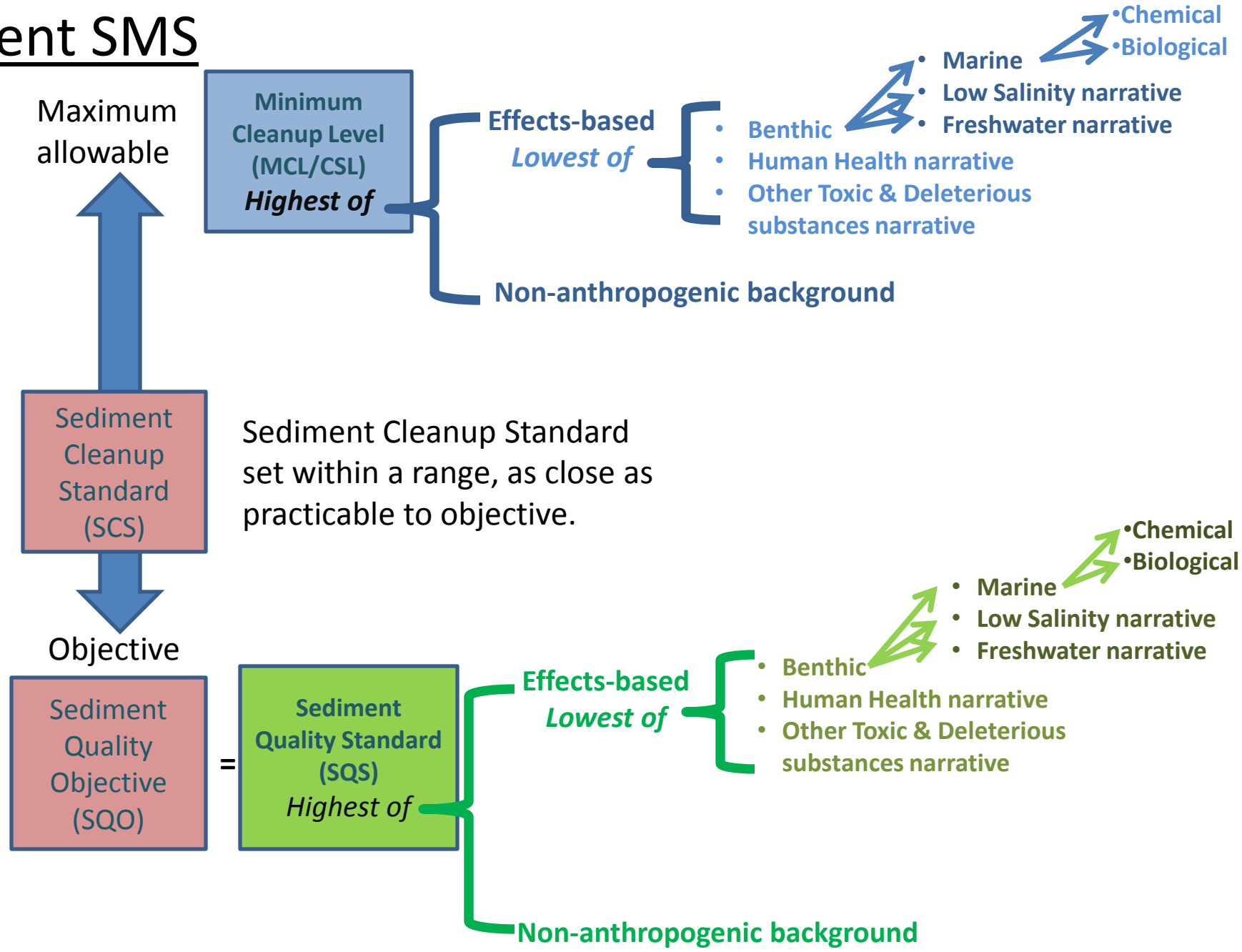

Highest of:
•1 x10^{-6} Risk
•Natural Bkgd
•PQL
Regional Bkgd
Highest of:
•1 x10^{-6} Risk
•Natural Bkgd
•PQL
80 % of
Regional Bkgd
Highest of:
•1 x10^{-6} Risk
•Natural Bkgd
•PQL
Highest of:
•1 x10^{-5} Risk
•Regional Bkgd
Highest of:
•1 x10^{-6} Risk
•Natural Bkgd
•PQL
Area Bkgd
Highest of:
•1 x10^{-6} Risk
•Natural Bkgd
•PQL
1
2
3
4
5

Short Description of Sediment Management Standards Structure

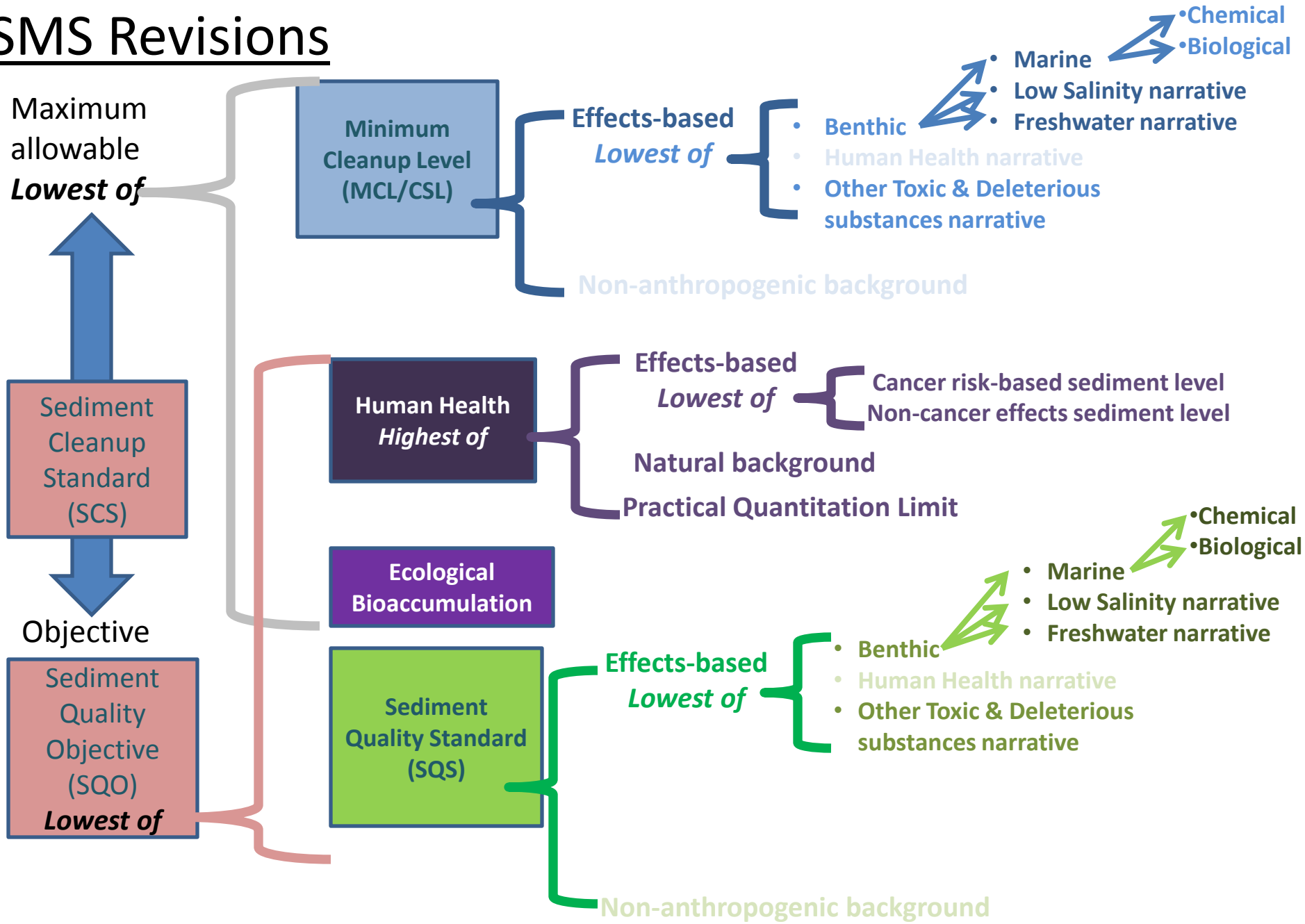


In the Sediment Management Standards, two different levels of criteria are used for three different purposes.

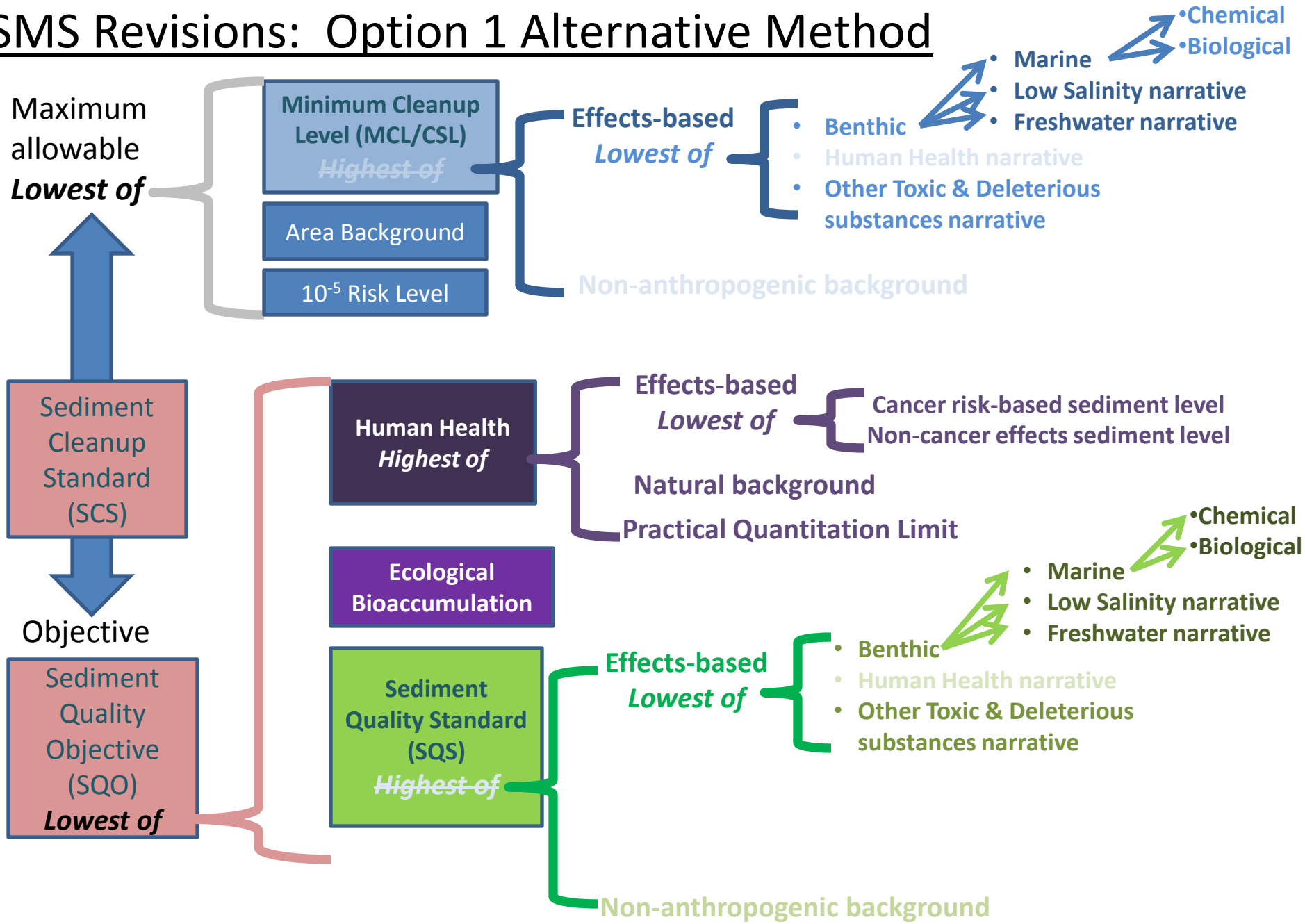
Current SMS


Maximum allowable
Minimum Cleanup Level (MCL/CSL)
Highest of
Effects-based
Lowest of
Benthic
Marine
•Chemical
•Biological
Low Salinity narrative
Freshwater narrative
Human Health narrative
Other Toxic & Deleterious substances narrative
Non-anthropogenic background
Sediment Cleanup Standard (SCS)
Sediment Cleanup Standard set within a range, as close as practicable to objective.
Objective
Sediment Quality Objective (SQO)
=
Sediment Quality Standard (SQS)
Highest of
Effects-based
Lowest of
Benthic
Marine
•Chemical
•Biological
Low Salinity narrative
Freshwater narrative
Human Health narrative
Other Toxic & Deleterious substances narrative
Non-anthropogenic background

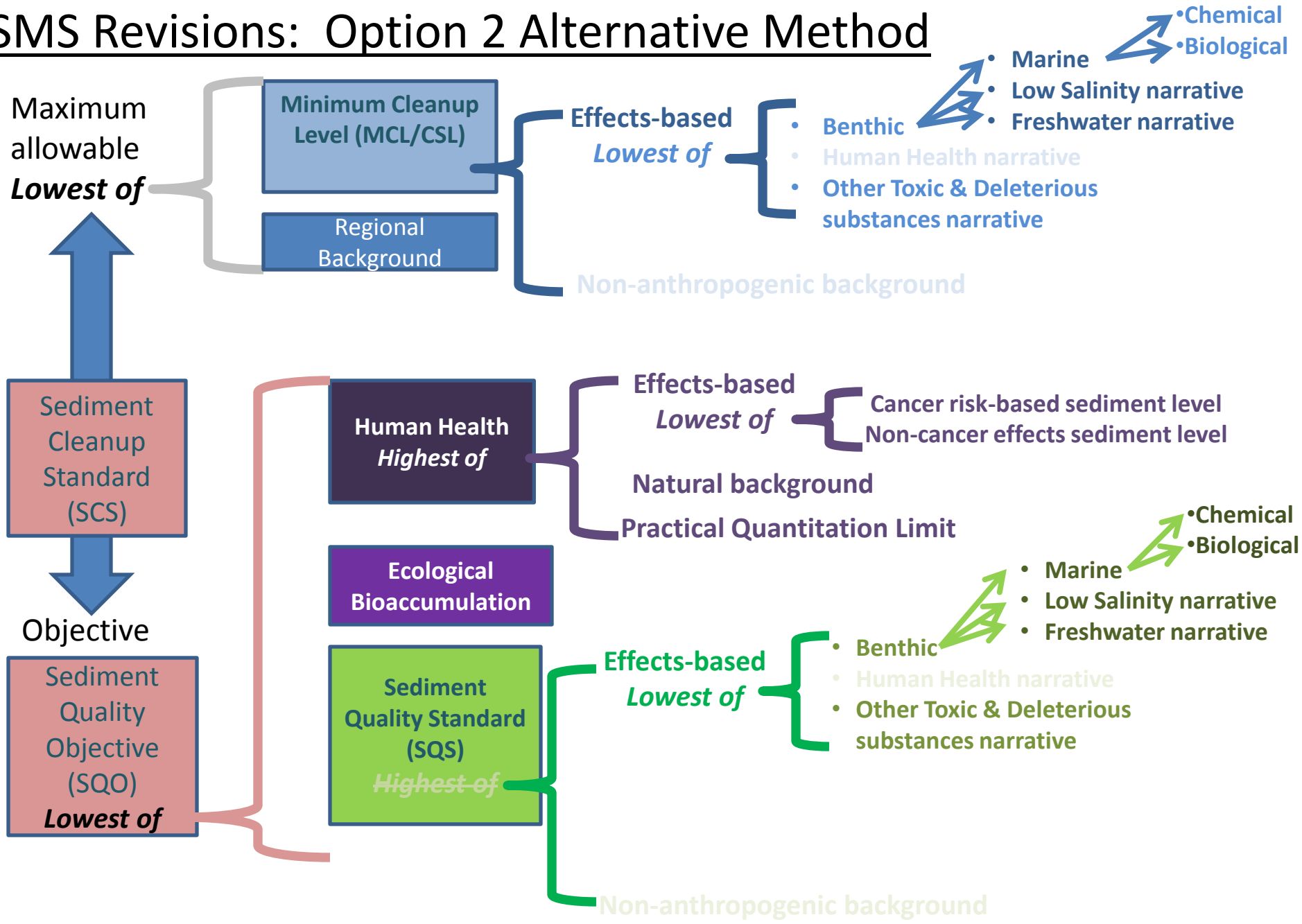
SMS Revisions

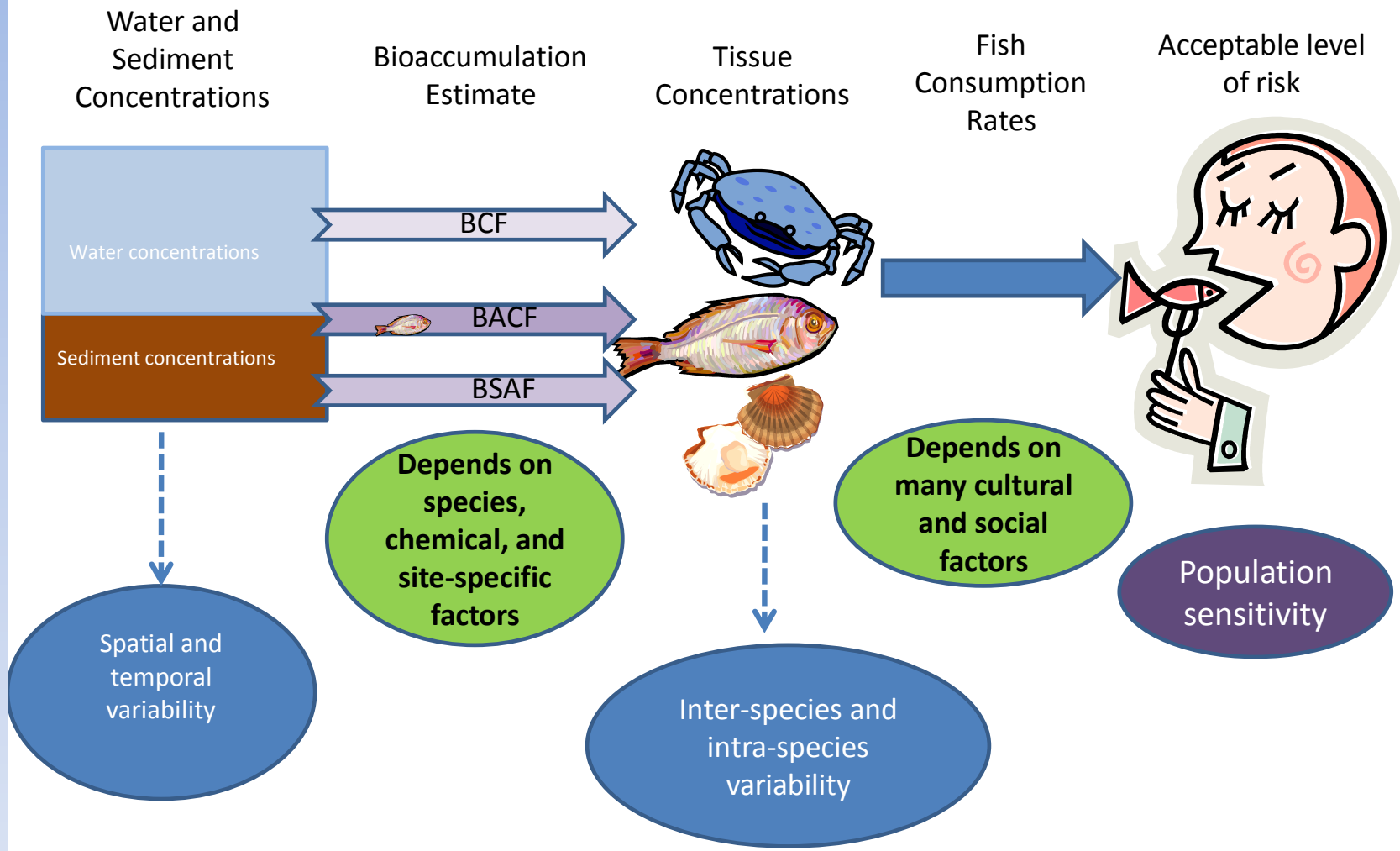


SMS Revisions: Option 1 Alternative Method

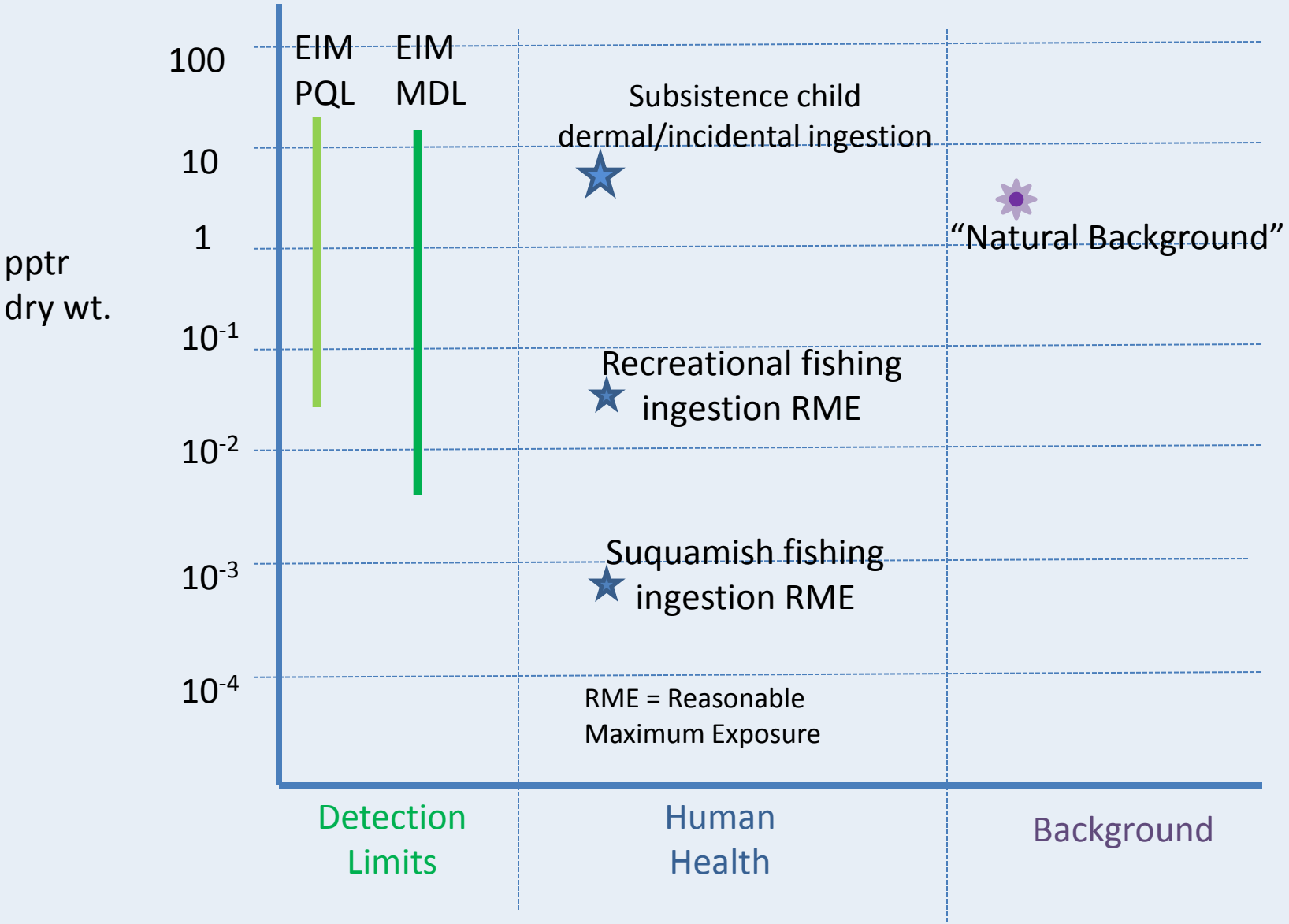


SMS Revisions: Option 2 Alternative Method

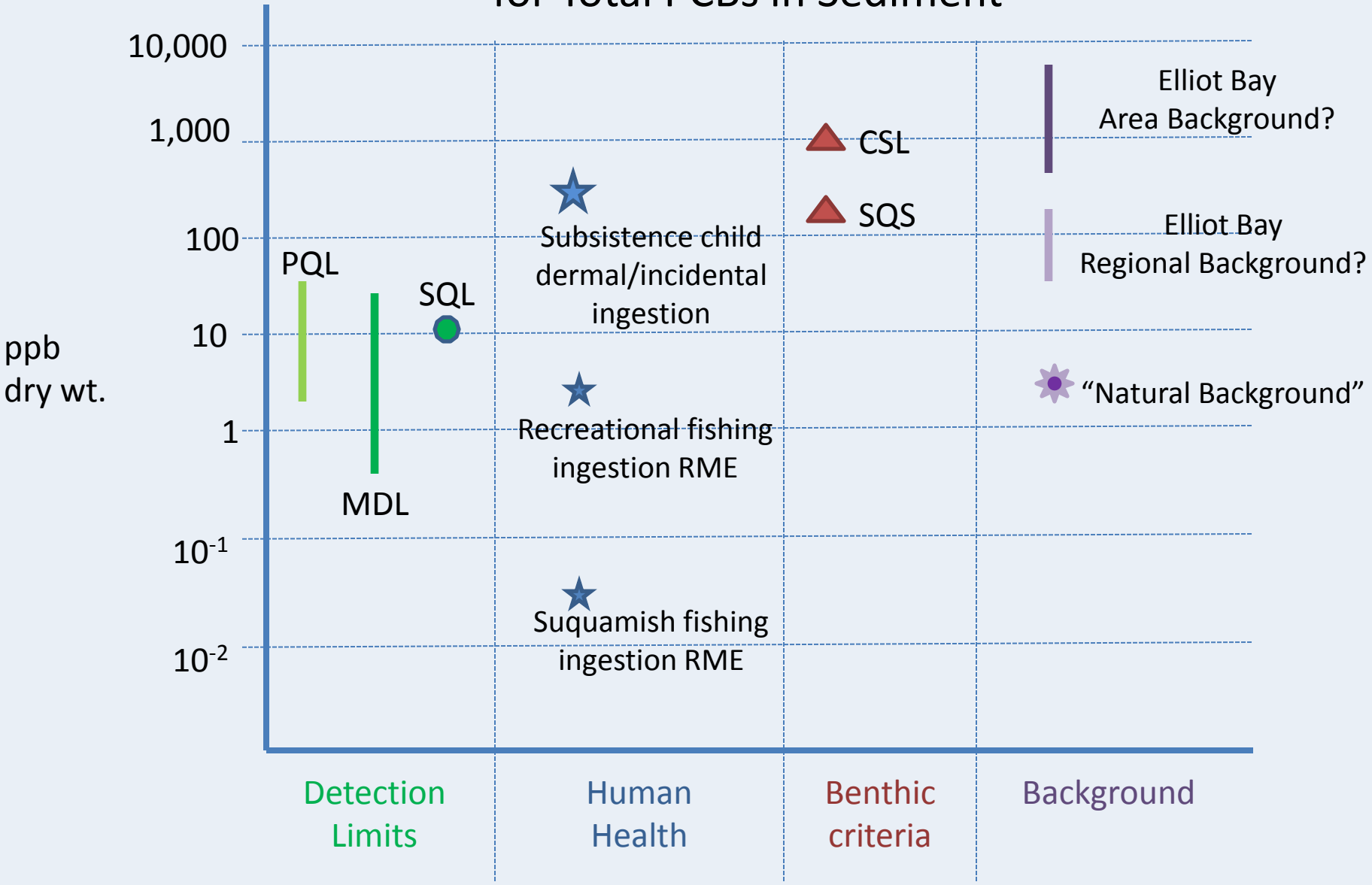



Water and Sediment Concentrations
Bioaccumulation Estimate
Tissue Concentrations
Fish Consumption Rates
Acceptable level of risk
Water concentrations
Sediment concentrations
BCF
BACF
BSAF
Depends on species, chemical, and site-specific factors
Depends on many cultural and social factors
Population sensitivity
Spatial and temporal variability
Inter-species and intra-species variability

Comparing Risk, Detection Limits and Natural Background for Dioxin/Furan TEQ in Sediment



Comparing Risk, Detection Limits and Natural Background for Total PCBs in Sediment



RME = Reasonable Maximum Exposure

Background Example
Sediment Workgroup
Jan 7th, 2010

Laura Inouye, presenter

Purpose

- To provide an example using real data to discuss the issues of determining regional background.

- Answer questions:
  - Does regional background provide sufficient flexibility to set cleanup standards that can be met?

  - Ideas on how to screen out sediment that is influenced by identifiable sources.

  - What are some alternative approaches for background? (Statistical metrics will be discussed at a later date).

Caveats

- These are for example purposes only to stimulate discussion and answer questions.
- These examples are not an Ecology proposed or settled approach.
- There are many recognized issues with this use of these datasets presented.

Example Background datasets

- Examples of “natural background”, “regional background”, and how this could impact site boundary delineations.

- Only looking at arsenic, mercury, and total PCB as examples, which represent a range of potential impacts and assist in highlighting issues with use of existing data to determine regional background.

Natural Background

- WAC 173-340-200. "…the concentration of hazardous substance consistently present in the environment that has not been influenced ***by localized*** human activities. …Also, low concentrations of some particularly persistent organic compounds such as polychlorinated biphenyls (PCBs) can be found in surficial soils and sediment throughout much of the state due ***to global distribution*** of these hazardous substances. These low concentrations would be considered natural background." (emphasis added)

- As an example only, data from the OSV *Bold* 2008 sediment sampling will represent natural background.

- Other available datasets could be used.

Natural Background

- For consistency, the following statistics could be used:
  - 90th UCL of the 90th percentile
  - Kaplan Meier (KM) approach for non-detects could be applied .
- But we didn't in this case;details of how data was handled for this example are in the supplemental information handout:
  - There were insufficient detections of Aroclors to use the KM approach.
  - Not appropriate to compare summed PCB congeners from the Bold dataset to summed Aroclor data for other datasets.
  - Insufficient Aroclor data in the Elliot Bay regional dataset to calculate 90th UCL of the 90th percentile, and we wanted to compare similar values.

Comparison of Natural Background to Numeric Criteria in the Sediment Management Standards

	"Natural"	SQS	CSL
Arsenic	11.3	57	93
Mercury	0.17	0.41	0.59
total PCBs	0	130	1000

As and Hg values are in ppm; total PCBs values are in ppb

Sediment Regional Background

- Our definition: Persistent, ubiquitous, uncontrollable contaminants at regional scale.

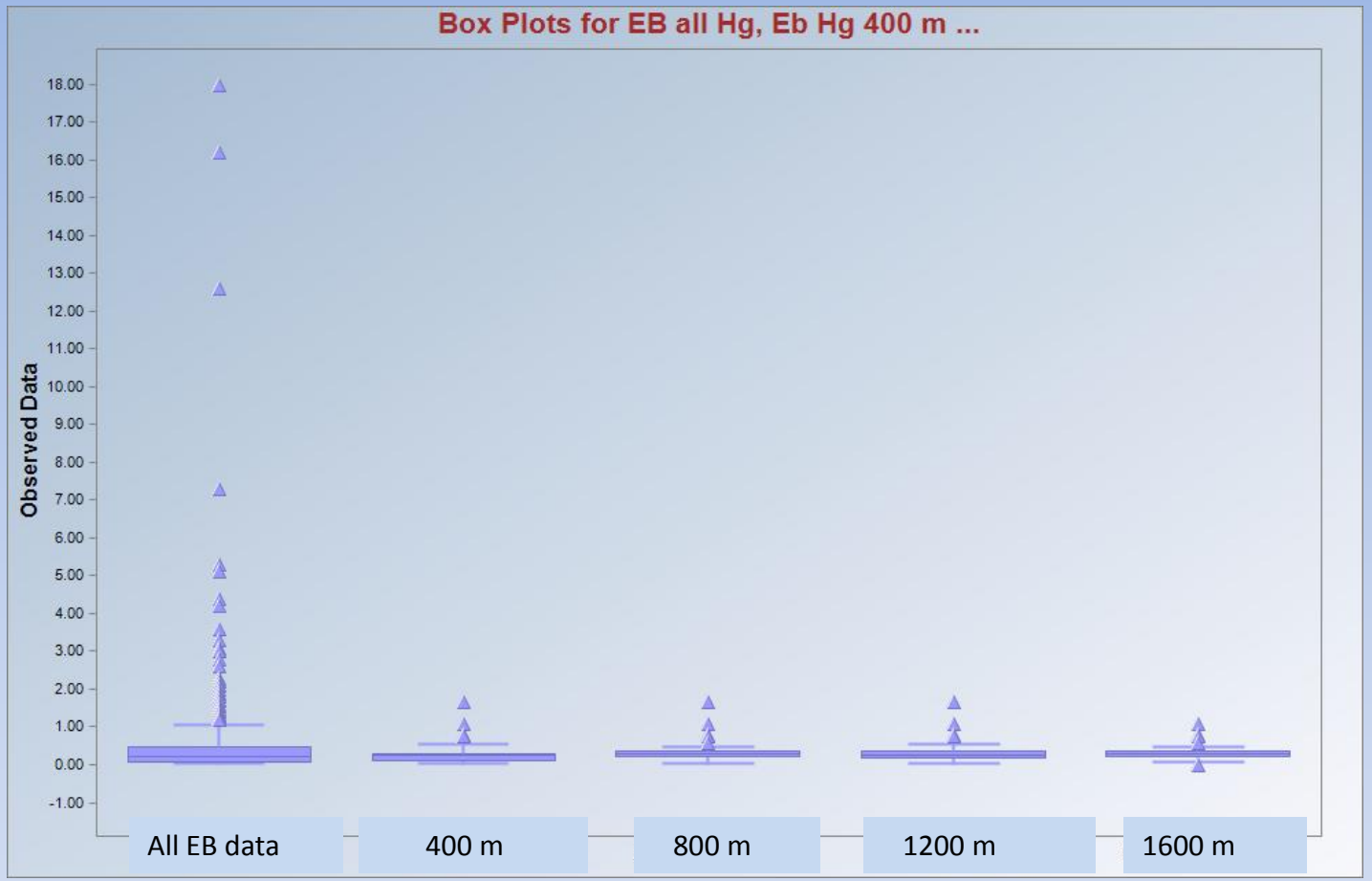
- As an example only, existing Elliot Bay data was used to develop regional background values for mercury, arsenic, and total PCBs.

- Example only!
  - Analysis based on data collected for other purposes. Data from multiple years, mostly collected as part of investigations (targeted known sites).

Sediment Regional Background

- "Away from point sources"
  - Treated shoreline, DMMP disposal site, and Renton Outfalls as sources.
  - 400, 800, 1200, and 1600 m from sources examined.
  - No major changes in distribution past 400 m.

Sediment Regional Background (Mercury example)



Variable	NumObs	Minimum	Maximum	Mean	Median	Variance	SD
EB all Hg	452	0	18	0.55	0.22	2.112	1.453
Eb Hg 400 m screen	79	0	1.69	0.259	0.239	0.0614	0.248
EB Hg 800 m screen	52	0	1.69	0.323	0.289	0.075	0.274
Eb Hg 1200 m screen	43	0	1.69	0.327	0.27	0.0901	0.3
Eb Hg 1600 m screen	28	0	1.08	0.337	0.292	0.0544	0.233

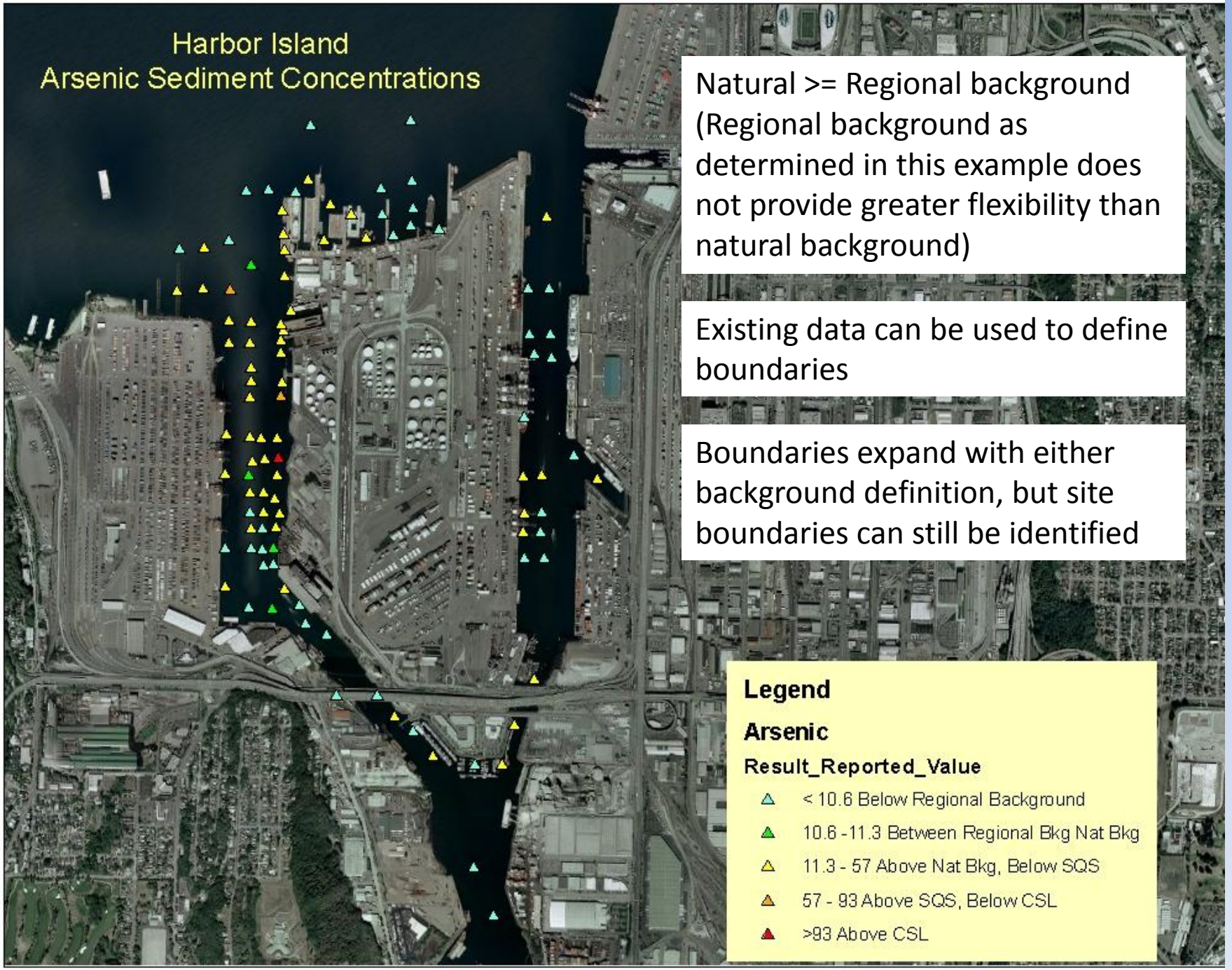
	400 m (median)		800 m (median)		1200 m (median)		1600 m (median)		**Bold (90th percentile)**
	nd 0	nd 0.5 DL	nd 0	nd 0.5 DL	nd 0	nd 0.5 DL	nd 0	nd 0.5 DL	**nd 0**
Arsenic ppm	**10.55**	10.9	10.95	10.95	10.9	10.9	11.29	11.29	**11.03**
Mercury ppm	**0.239**	0.239	0.289	0.289	0.27	0.27	0.292	0.292	**0.17**
total PCBs ppb	**51**	51	NA	NA	NA	NA	NA	NA	**0**

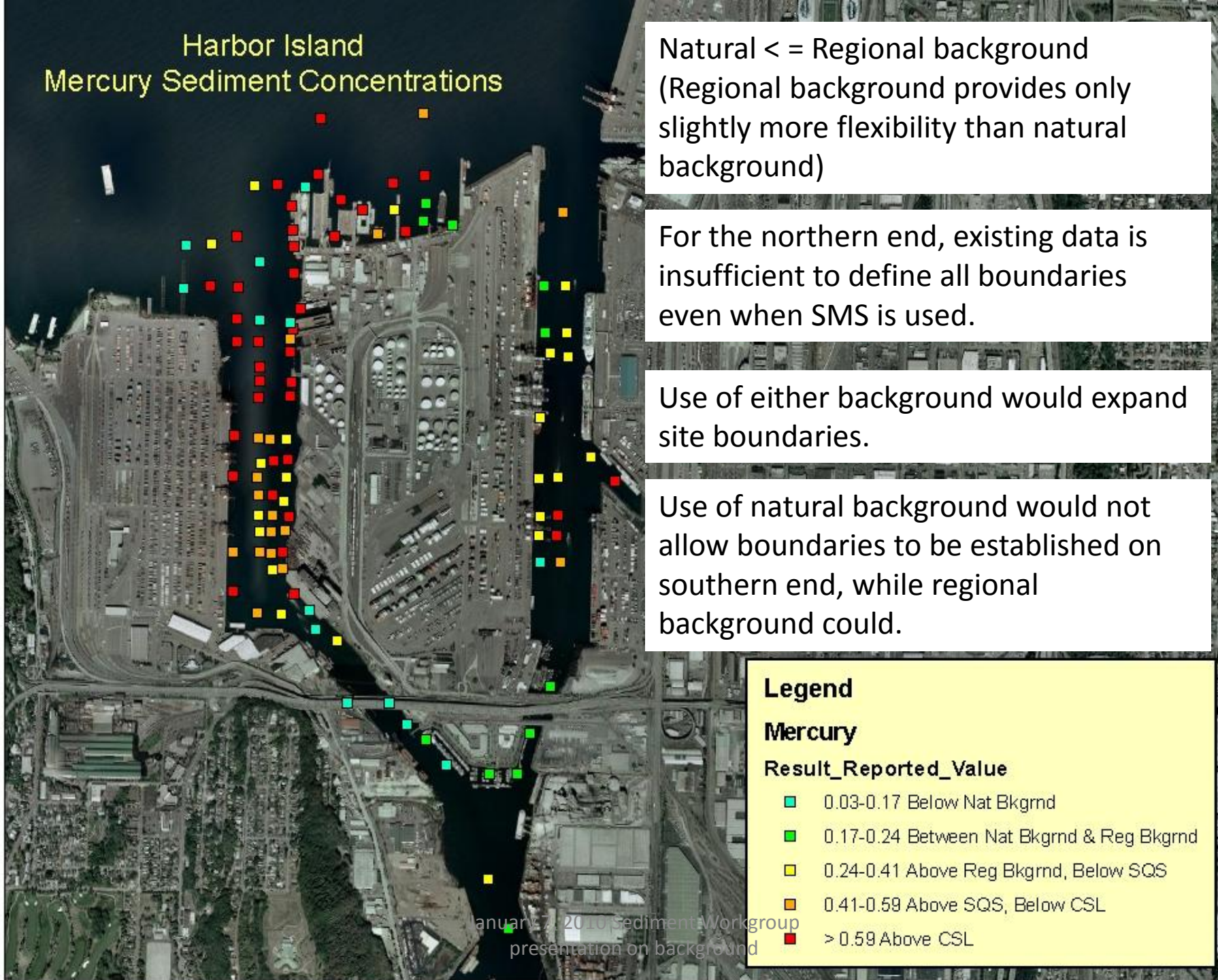
	"Regional" median	"Regional" 90th %ile	"Natural" 90th %ile	SQS	CSL
Arsenic ppm	10.6	29.6	11.3	57	93
Mercury ppm	0.24	0.45	0.17	0.41	0.59
total PCBs ppb	51	109	0	130	1000

Site Example: HIRI P2, Harbor Island

- Example only - useful for discussing potential impacts of application of natural background and regional background concepts

- Large Dataset within the Elliot Bay system
  - Used surface sediment data only
  - averaged field and lab replicates
  - ND= 0


Harbor Island
Arsenic Sediment Concentrations
Natural >= Regional background (Regional background as determined in this example does not provide greater flexibility than natural background)
Existing data can be used to define boundaries
Boundaries expand with either background definition, but site boundaries can still be identified
Legend
Arsenic
Result_Reported_Value
< 10.6 Below Regional Background
10.6 -11.3 Between Regional Bkg Nat Bkg
11.3 - 57 Above Nat Bkg, Below SQS
57 - 93 Above SQS, Below CSL
>93 Above CSL

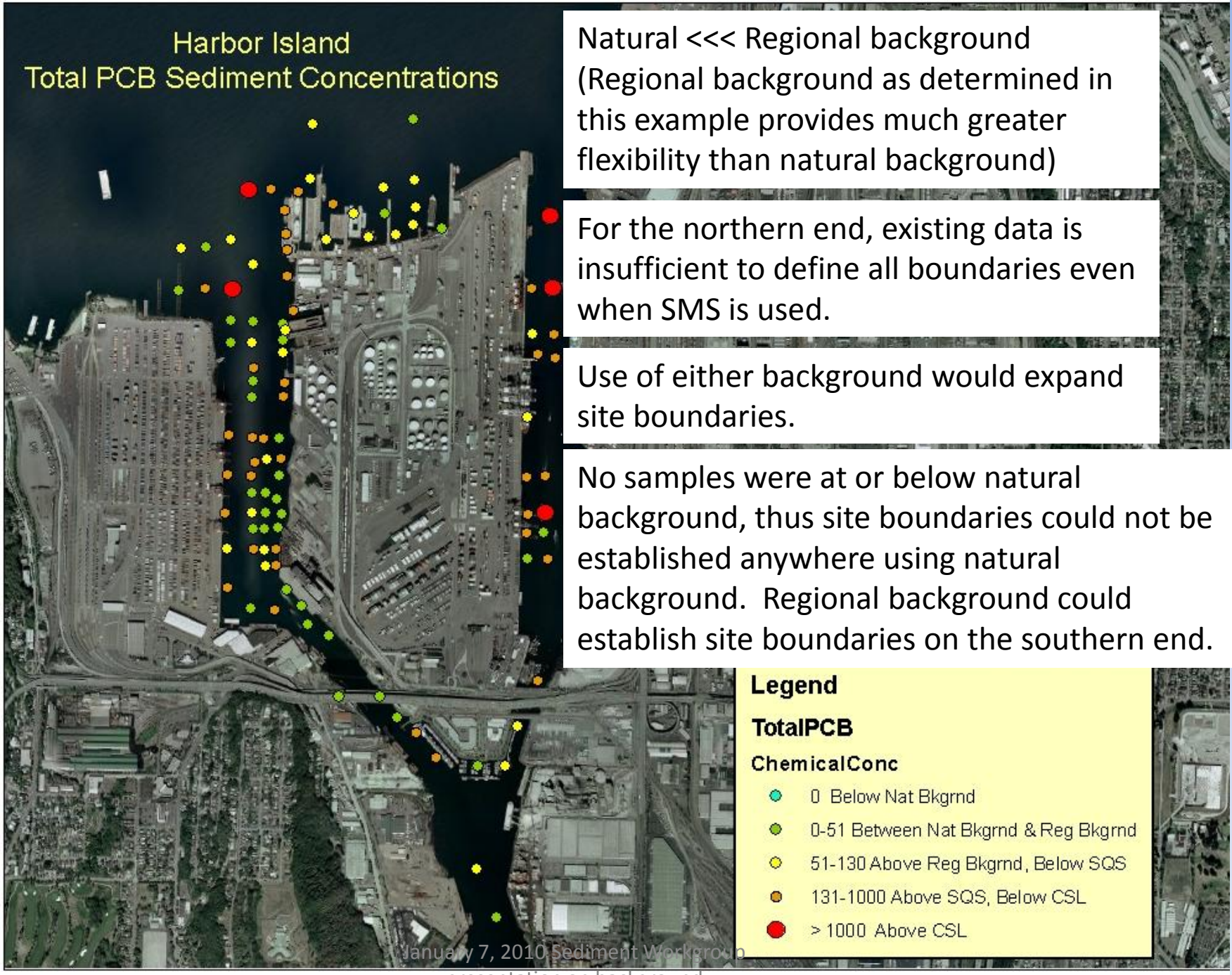


Natural < = Regional background (Regional background provides only slightly more flexibility than natural background)

For the northern end, existing data is insufficient to define all boundaries even when SMS is used.

Use of either background would expand site boundaries.

Use of natural background would not allow boundaries to be established on southern end, while regional background could.



Natural <<< Regional background (Regional background as determined in this example provides much greater flexibility than natural background)

For the northern end, existing data is insufficient to define all boundaries even when SMS is used.

Use of either background would expand site boundaries.

No samples were at or below natural background, thus site boundaries could not be established anywhere using natural background. Regional background could establish site boundaries on the southern end.

	"Regional" median	"Regional" 90th %ile	"Natural" 90 %ile	SMS	CSL
Arsenic ppm	10.6	29.6	11.3	57	93
Mercury ppm	0.24	0.45	0.17	0.41	0.59
total PCBs ppb	51	109	0	130	1000

- Some sort of background approach is needed to address bioaccumulative risks.
- There is not much difference between natural and regional median background for arsenic.
- There is more difference between natural and median background for mercury.
- There is a large difference between natural and median background for total PCBs.
- The statistical metric selected can result in very different values.

Lower Duwamish Waterway Background Example Sediment Workgroup Jan 7th, 2010

Brad Helland

Purpose

- To provide an example using actual surface sediment data to discuss the issues around determining regional background.
- Would sediment cleanup standards derived from upstream (regional) background data be significantly different from standards derived from natural background?

Caveats

- All datasets and analyses are for discussion purposes only.
- Preliminary approaches utilizing various background datasets are under discussion by EPA, Ecology, Lower Duwamish Waterway Group (Seattle, King Co., Boeing, Port of Seattle), and stakeholders.
- There are many recognized issues with this use of various datasets and analytical (statistics and chemistry) techniques.

Natural Background Datasets

- Data from the OSV *Bold* 2008 sediment sampling (n=70) are used to represent natural background for PCBs, PAHs, and dioxins and furans.
- For arsenic, data from historical sediments in deep cores (n=15) are used to represent natural background. Data from the BOLD survey are also shown for comparison.
- Other datasets could be generated; alternative existing datasets may be used, but it is difficult to identify data that inappropriately include influences from significant sources.

Sediment Regional Background

- Background approach cited in Option 2

MTCA SMS options paper

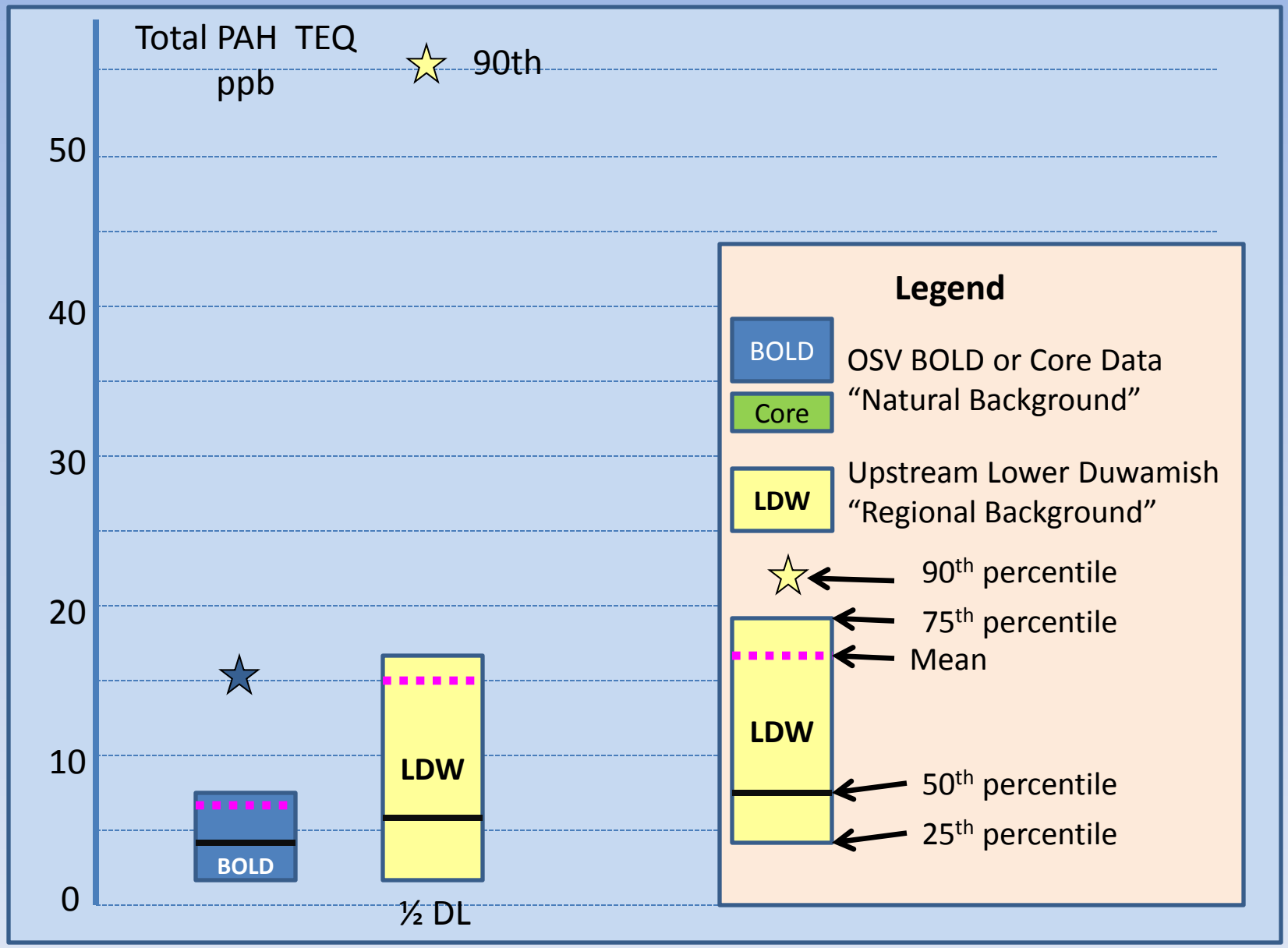
- Data from areas upstream of the LDW (n=71) could represent regional background for PCBs, PAHs, and D/F.

- Other datasets could be generated; alternative existing datasets may be used.

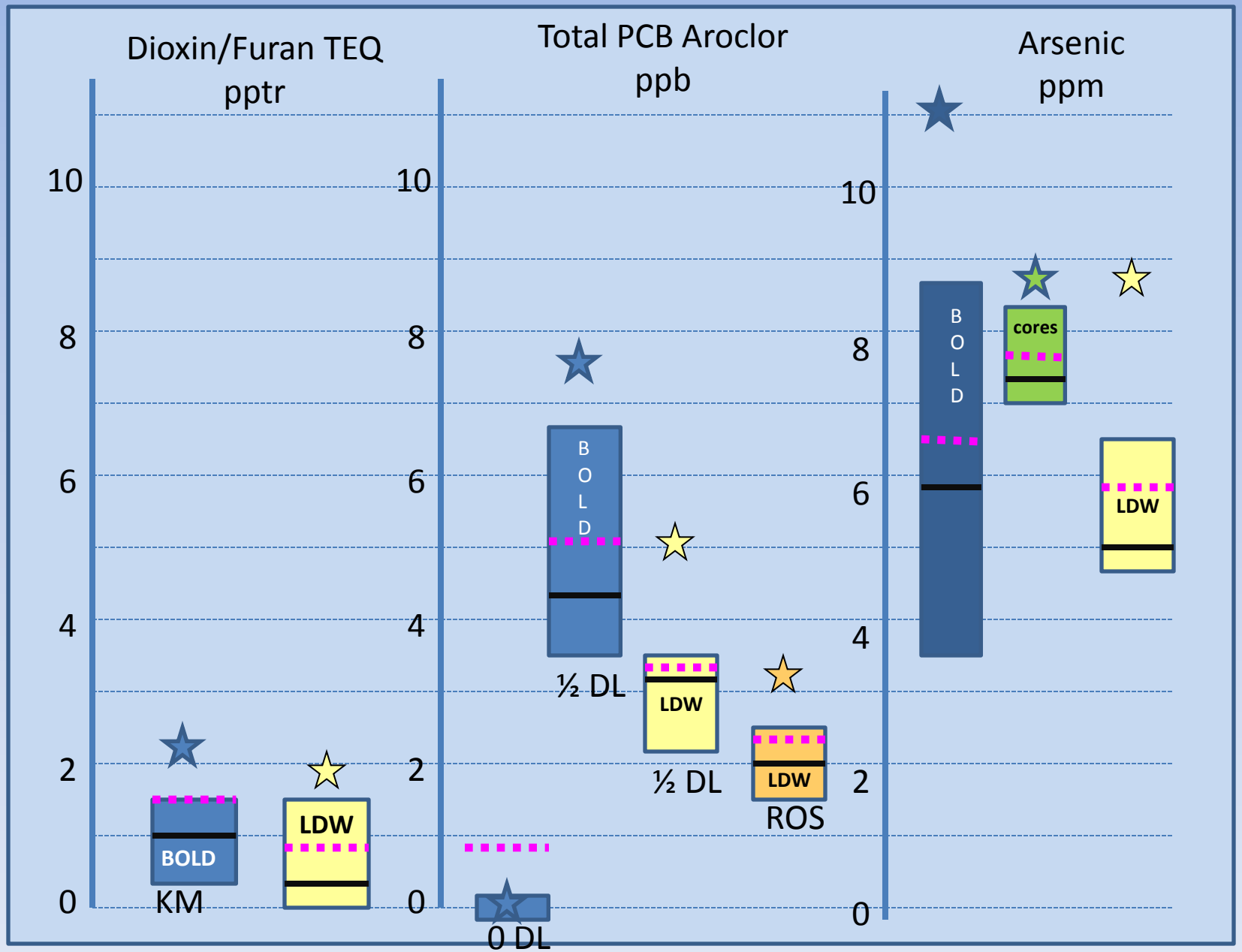
Background Datasets Statistics

- Descriptive statistics used:
  - Percentiles
  - Mean
  - Kaplan Meier (KM) or regression on order statistics (ROS) for non-detects could be applied

Comparison of “Natural Background” Data to “Regional Background” Data



Comparison of “Natural Background” Data to “Regional Background” Data



Conclusions

- Difficult to determine influence of point sources.
- Sediment regional background is not higher than natural background for some chemicals and some locations. It is higher for some chemicals and some locations.
- Choice of metrics, methods of comparison, and treatment of non-detects can be important when comparing sites to background.

Areas of adjustment

Set Cleanup Standard	Remedy Selection and Implementation	Resolution
•Consideration of background • Exposure assumptions •Acceptable risk range or range of effects.	•Engineered controls •Institutional controls • Remediation Levels •Recovery Time Frame	•Compliance •Location •Concentration (Statistical comparison) •Time •Interim actions • Sediment Recovery Zones • Partial Settlements? •Mitigation?

End